Discrimination of C18 fatty-acids by [i]Drosophila melanogaster[/i] larvae and adults (wild-type strain, Dijon 2000)

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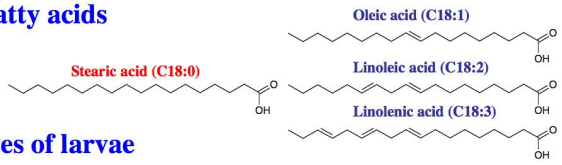
The biological basis of fat perception and preference remains poorly understood. Both vertebrates and insects share elaborate olfactory and gustatory sensory systems to respectively decrypt the compounds present in their chemical environment. This suggests that the genes underlying the metabolic pathways regulating food intake could be conserved between Drosophila and vertebrates.

The tested C18 fatty acids

In drosophila, as in other insects, fatty acids are generally part of the biosynthetic pathways of the cuticular hydrocarbons and of various other chemical compounds. All the tested acids are present in the medium food.



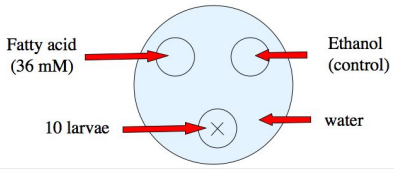
Behavioral responses of larvae

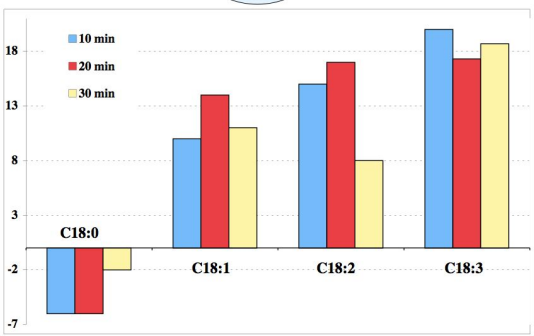
A closed Petri dish (9 cm diameter) was used as behavioral arena. The floor was covered with a Whatman filter paper. The fatty acids were tested at the concentration of 36 mM in ethanol. Each test was repeated 10 times.

To test the potential acid attractivity on larvae, 50 µl of the diluted acid and 50 µl of ethanol were randomly deposited on one of the spots (3 cm diameter). After evaporation of the alcohol, 1 ml of distilled water was added onto the filter paper. Then, 10 grouped larvae (middle of 3rd instar stage) were gently put on the third spot. The number of larvae present on the spots was noted every 5 min during a 30 min period.

To test the potential repulsivity of the acids, the larvae were directly deposited on the spot. The number of larvae remaining on the spot was noted every 30 sec during a 10 min period.

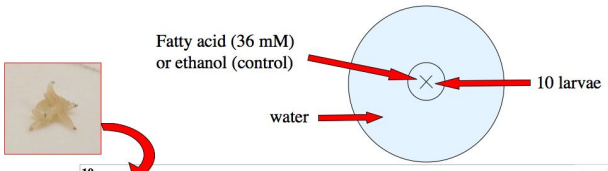
Larvae Attraction

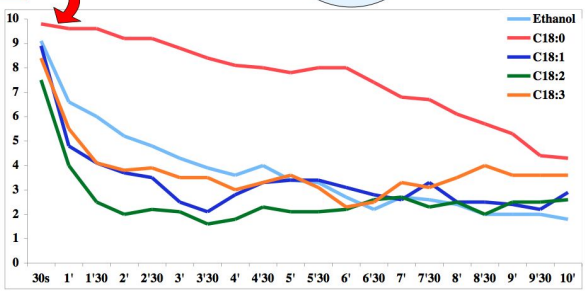




Results: Larvae are clearly repulsed by the tested saturated acid (C18:0) and prefer the unsaturated fatty acids in which C18:3 remains the most attractive. Pure ethanol does not show any attraction for larvae (level 0 on the Y-axis). Ordinate: (number of attracted larvae on acid - number of attracted larvae on ethanol) x 10; mean value.

Larvae Repulsion

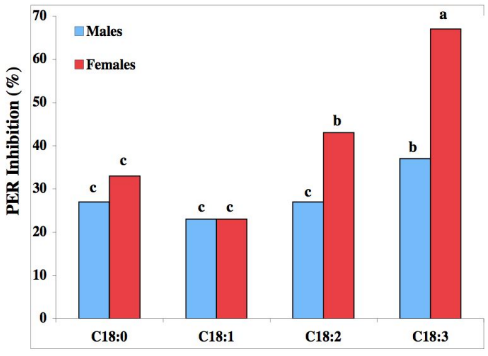


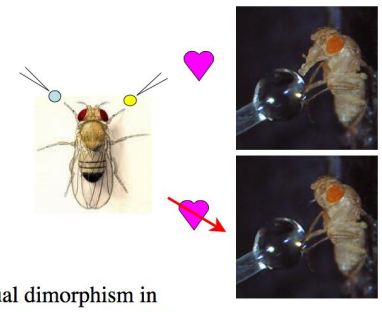


Results: In contrast to the attraction tests, the larvae remained longer on the saturated fatty acid compared to the unsaturated acids. A careful observation reveals that larvae could aggregate and form a sort of ball to avoid any contact with the C18:0 acid; this tends to delay their moving out of the spot.
Ordinate: number of larvae present on the spot.

Behavioral responses of adults

A bilateral stimulation (forelegs) was designed to measure how the contact with a fatty acid (36 mM) could inhibit the appetent effect induced by glucose (100 mM) on the proboscis extension reflex (PER) of 4-day-old virgin males and females.





Results: Our data revealed a strong sexual dimorphism in response to the various fatty acids. Males show a weak PER repression by most tested acids (25-30%) and moderate by C18:3 (37%) whereas females show a more contrasted response (25-67%). Comparatively to the males, C18:2 and C18:3 strongly represses PER in the females (43 and 67%, respectively).

CONCLUSION: For the first time, our data unambiguously prove that larvae and adults of a wild-type strain of *Drosophila melanogaster* are able to discriminate between various common fatty acids. Larvae clearly prefer unsaturated acids and this effect seems to involve both olfaction and taste perception. Surprisingly, groups of larvae could cooperate to avoid any contacts with saturated acid. Adults showed a different preference pattern compared to larvae: their "appetitive" response was inhibited more often by unsaturated than by saturated fatty acids. These data suggest that drosophila are able to discriminate fatty acids and can change preference during lifetime; this may reflect a variation in nutritional requirement during development.